

Remarks

The Examiner is thanked for courtesies extended in granting an interview in the above captioned application to Dr. James Baker and the undersigned on April 14, 2005. During this interview, the history of advances in toner technology, particularly in the use of amphipathic copolymers in toners in the past and in currently pending patent applications, was discussed. The differences between copolymers prepared in aqueous media either as a suspension or emulsion polymerization reactions and amphipathic copolymers prepared in solvents as described in the present application were also discussed. The different development stages and toner discoveries for use in different printing processes were also discussed. Early systems were described having toner particles with very low Tg polymers that were imaged and adhesively transferred by an adhesive overlamine sheet. Liquid toners, including gels, were also discussed that comprised mid-range Tg toner particles that were formed a film on the photoreceptor and transferred as a film and subsequently fused to a substrate. Phase change developer systems were also discussed, wherein a toner is provided in a system that is solid at room temperature, but which is converted to a liquid toner, for example by heating, prior to imaging. The imaging process in the phase change developer system thus is a liquid toner system.

Issues related to creation of dry toner particles from toner particles prepared in liquids, and issues related to printing from liquid toner compositions without film formation on the photoreceptor were also discussed.

Amendments

Claims 1 and 19 have been amended to insert language regarding the S and D material portions of the amphipathic copolymer. Antecedent basis for this amendment is located in the specification at page 14, lines 4-14.

The specification has also been amended to update pending application status information.

It is respectfully submitted that no new matter is introduced by these amendments.

Claim Rejections

Claims 1 and 19 have been rejected under 35 USC 112, second paragraph as being indefinite.

More specifically, claims 1 and 19 have been stated to be indefinite in the terms S and D. These claims have been amended to relate these terms to the carrier liquid.

Claims 1-23 have been rejected under 35 USC 103 as being unpatentable over Baker 6,649,316 in view of Elmasry 5,302,482 and Jongewaard 4,988,602.

The present claims relate to gel liquid electrophotographic toner compositions comprising a liquid carrier and toner particles dispersed in the liquid carrier. The liquid carrier has a Kauri-butanol number less than 30 mL. The toner particles comprise a polymeric binder comprising at least one amphipathic copolymer with one or more S material portions and one or more D material portions. The amphipathic copolymer comprises covalent crosslinking functionality in an amount sufficient to provide a three dimensional gel of controlled rigidity which can be reversibly reduced to a fluid state by application of energy. The electrophotographic toner composition substantially does not form a film under Photoreceptor Image Formation conditions.

As noted in the claims and the specification, the gel is formed by incorporating a low percentage of monomer having a crosslinkable functionality in the amphipathic copolymer, and crosslinking the amphipathic copolymer to form intermolecular covalent bonds in an amount sufficient to form a gel. Thus, the resulting composition is a gel formed by intermolecular crosslinks between amphipathic copolymer molecules. See the specification at page 30, lines 23-24.

Gel toner compositions that do not substantially form a film under Photoreceptor Image Formation conditions provide specific advantages, including excellent image transfer from the photoreceptor, with low or no back transfer of the image to the photoreceptor during the printing process. Additionally, the gel toner compositions exhibit exceptional storage stability without the need to incorporate dispersant, surfactant, or stabilizer additives in an amount deleterious to image quality, although these additional components can be used if desired. Superior final image properties are also observed relative to erasure resistance and blocking resistance. The gels impart useful

properties to the liquid ink, notably improved sedimentation stability of the colorant, without compromising print quality or ink transfer performance. The inks formulated with the gels also exhibit improved redispersion characteristics upon settling, and do not form dilatant sediments such as those formed by non-gelled organosol inks.

Baker 6,649,316 describes a phase change developer comprising: (a) a carrier having a Kauri-butanol number less than 30; and (b) an organosol comprising a graft (co)polymeric steric stabilizer covalently bonded to a thermoplastic (co)polymeric core that is insoluble in said carrier, and said (co)polymeric steric stabilizer comprises a crystallizing polymeric moiety that independently and reversibly crystallizes at or above 30°C, wherein said phase change developer has a melting point at or above 22°C.

As noted in the Baker '316 specification beginning at column 11, line 52, the term "phase change developer" has an accepted meaning within the imaging art. As the term indicates, the developer system is present as one physical phase under storage conditions (e.g., usually a solid) and transitions into another phase during development (usually a liquid phase), usually under the influence of heat or other directed energy sources. Thus, in the system as described in Baker '316, the toner is converted from a solid form to a liquid form prior to development, so that the toner as described first is in the solid form, and then through a specific manipulation is converted to liquid form under image formation conditions so that the actual image formation process is carried out in the form of a liquid. See column 2, lines 21-25. This solid form is not created by intermolecular crosslinks between amphipathic copolymer molecules, but rather by crystallizable polymeric moieties in the graft stabilizer in an amount sufficient to form a toner composition that is a solid at temperatures below 22°C.

Baker '316 therefore does not teach or suggest a gel toner composition comprising covalent crosslinking functionality in an amount sufficient to provide a three dimensional gel of controlled rigidity which can be reversibly reduced to a fluid state by application of energy as presently claimed.

Additionally, Baker '316 describes a toner system wherein the toner is designed to form an image on the surface of a photoconductor with film formation on the photoconductor, which formed film is then transferred to an intermediate transfer

material or directly to a print medium. See, e.g. Column 14, lines 64-65, which describes the drying of the film on the photoconductive element surface. This image formation system is in contrast to the presently claimed system, which specifically requires that the electrophotographic toner composition does not form a film under Photoreceptor Image Formation conditions.

Elmasry 5,302,482 describes liquid toners comprising a carrier liquid, a pigment particle and a coordinated association of steric stabilizer and charge directing moiety. The polymeric particles of the Elmasry toners have copolymeric steric stabilizer groups adhered to their surfaces, and the copolymeric stearic stabilizer have moieties attached thereto. These moieties comprise coordinating groups and metal soap groups that form coordinate bonds with said coordinating groups. As noted in the Elmasry specification at column 2, lines 15-25, the stabilizer of the graft copolymer consists mainly of two polymeric components, which provide one polymeric component soluble in the continuous phase and another component insoluble in the continuous phase. The soluble component is responsible for the stabilization of the dispersion against flocculation, by preventing particles from approaching each other so that a sterically-stabilized colloidal dispersion is achieved. Thus, the Elmasry particle construction is designed to avoid interaction of the particles. In contrast, the present toner composition requires that the copolymer comprises covalent crosslinking functionality in an amount sufficient to provide a three dimensional gel of controlled rigidity which can be reversibly reduced to a fluid state by application of energy. Thus, the copolymers of the present toner composition must have interaction, rather than avoiding interaction as taught in the Elmasry disclosure.

Additionally, the toners as described in Elmasry expressly must coalesce into a resinous film after being electrophoretically deposited onto a photoconductive substrate. See column 6, lines 20-24. Again, this is contrary to the express requirement of the compositions of the present claims, which do not form a film under Photoreceptor Image Formation conditions.

Jongewaard 4,988,602 describes liquid toners for developing electrophotographic images that contain dispersed toner particles that are based on a polymer with multi-characteristics. The particles described therein comprise a thermoplastic resinous core

with a T_g below room temperature, which is chemically anchored to an amphipathic copolymer steric stabilizer containing covalently attached groups of a coordinating compound which in turn are capable of forming covalent links with organo-metallic charge directing compounds and a thermoplastic ester resin that functions as a charge enhancing component for the toner. The toners as described in this reference are specifically designed to film form on the photoreceptor so that overprinting with sequential colors can be carried out prior to transfer of the film to the receptor sheet. See column 7, lines 35-37 and column 14, line 56 to column 15, line 3.

It is respectfully submitted that the above discussed references would not have individually or in combination suggested the toner compositions of the present claims. Further, the skilled artisan would have had no motivation to prepare a gel toner composition as presently claimed, wherein a reversible gel is formed through covalent crosslinking functionality in the amphipathic copolymer in an amount sufficient to provide a three dimensional gel of controlled rigidity. Additionally, the references do not teach or suggest preparation of a gel toner composition that substantially does not form a film under Photoreceptor Image Formation conditions, as required in the present claims.

Finally, the skilled artisan could not have predicted that such toner compositions would exhibit superior performance properties, such as excellent image transfer from the photoreceptor, exceptional storage stability, and superior final image properties relative to erasure resistance and blocking resistance.

Claim Rejections – Double Patenting

Claims 1-23 have been provisionally rejected under the judicially created doctrine of obviousness-type double patenting over claims 1-24 of copending Application No. 10/612,058 and 10/612,182.

In order to overcome this provisional rejection and to expedite prosecution, a terminal disclaimer in view of copending Application Nos. 10/612,058 and 10/612,182 is enclosed without prejudice.

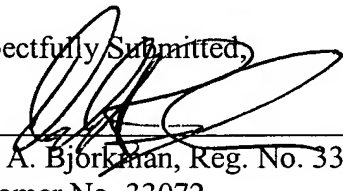
Enclosed is a check for \$130.00 that includes the fee for a Statutory Disclaimer.

Conclusion

In view of the above remarks, it is respectfully submitted that the foregoing is fully responsive to the outstanding Office action. In the event that a phone conference between the Examiner and the Applicant's undersigned attorney would help resolve any issues in the application, the Examiner is invited to contact said attorney at (651) 275-9811.

Date: June 9, 2005

Respectfully Submitted,

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